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Counties Manukau District Health Board
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10 May 2019

Attention: Chester Buller

Dear Chester

Franklin Memorial Hospital - Intrusive Investigation Summary

Beca has been engaged to complete intrusive investigations at the Franklin Memorial Hospital site at Waiuku, Auckland. The investigation findings will inform the next steps of the seismic assessment and strengthening process. This letter summarises our findings and provides options and recommendations for Counties Manukau Health (CMH) to consider.

Background

Beca recently completed a number of Initial Seismic Assessments (ISAs) for a number of Counties Manukau Health facilities across the Auckland region.

The purpose of an ISA is to act as first step in the overall seismic assessment process. It is a coarse evaluation of a building, that can inform decision makers as to a priority list of buildings. If important decisions need to be made that rely on a buildings seismic status, generally an ISA is followed up with a Detailed Seismic Assessment (DSA).

The Franklin Memorial Hospital was the oldest building assessed and received an earthquake prone score, with 30%*NBS* (IL3). The extensive use of unreinforced masonry for load bearing walls and chimneys in the building severely influences the building score, due to their known poor earthquake behaviour. The Assessment Guidelines recommend structures with unreinforced masonry chimneys and load bearing walls be considered as earthquake prone until the stability of the walls and effectiveness of the restraint of the masonry can be confirmed. Because of this, we recommended intrusive investigations be undertaken to confirm details, followed by the development of structural remedial solution to address the potential critical structural weaknesses.

Intrusive Investigation Summary

Methodology

A Beca structural engineer undertook a site visit on 01 May 2019. During the development of the intrusive investigation scope of works it was identified that the ceiling space was unable to be accessed due to the presence of asbestos material. The inspection was therefore limited to areas available to be inspected from ground level.

A reinforcing scanner was used to detect brick veneer ties and determine their distribution to the walls. Access to the subfloor space was limited to that able to be observed through removed vent holes.

Observations

The observations are summarised as follows:

- Bricks – the bricks were measured as 210 mm long, 76 mm deep, and 100 mm wide. The bricks were noted as being ‘hard’ as they were unable to be scratched with a coin. The hardness of the brick, relative to the mortar is important as it can lead to a brittle failure mechanism.
- Mortar – the mortar joints were approximately 10 mm thick. The mortar did not scratch away easily when using a key, suggesting it is also ‘hard’.

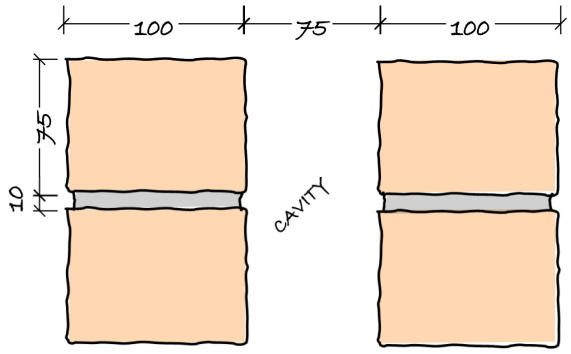

Figure 1: Typical brick dimensions and cavity layout

- Exterior Walls - the exterior walls are cavity brick construction. This consists of a single exterior veneer layer of bricks approx. 100 mm wide, a cavity 75 mm wide, then an internal brick layer. Beneath the floor level, the brick becomes solid to form a perimeter foundation wall. Cavity ties were observed to be at approximately 900 mm centres horizontally, and 1000 mm centres vertically. The ties appear as approximately an 8 gauge wire.

Figure 2: Evidence of cavity ties in external walls

- Interior Walls – the interior walls are generally single brick with plaster linings directly fixed to the brick surface. In the northern area of the building where renovation works have been undertaken, timber stud walls have been constructed adjacent to the brick partition walls, but are unlikely to have a physical connection between the studs and the brick.

  There is some evidence of internal double brick cavity walls. The construction of these, including cavity width is expected to be similar to the exterior walls.

  The connection to the top plate was unable to be observed.

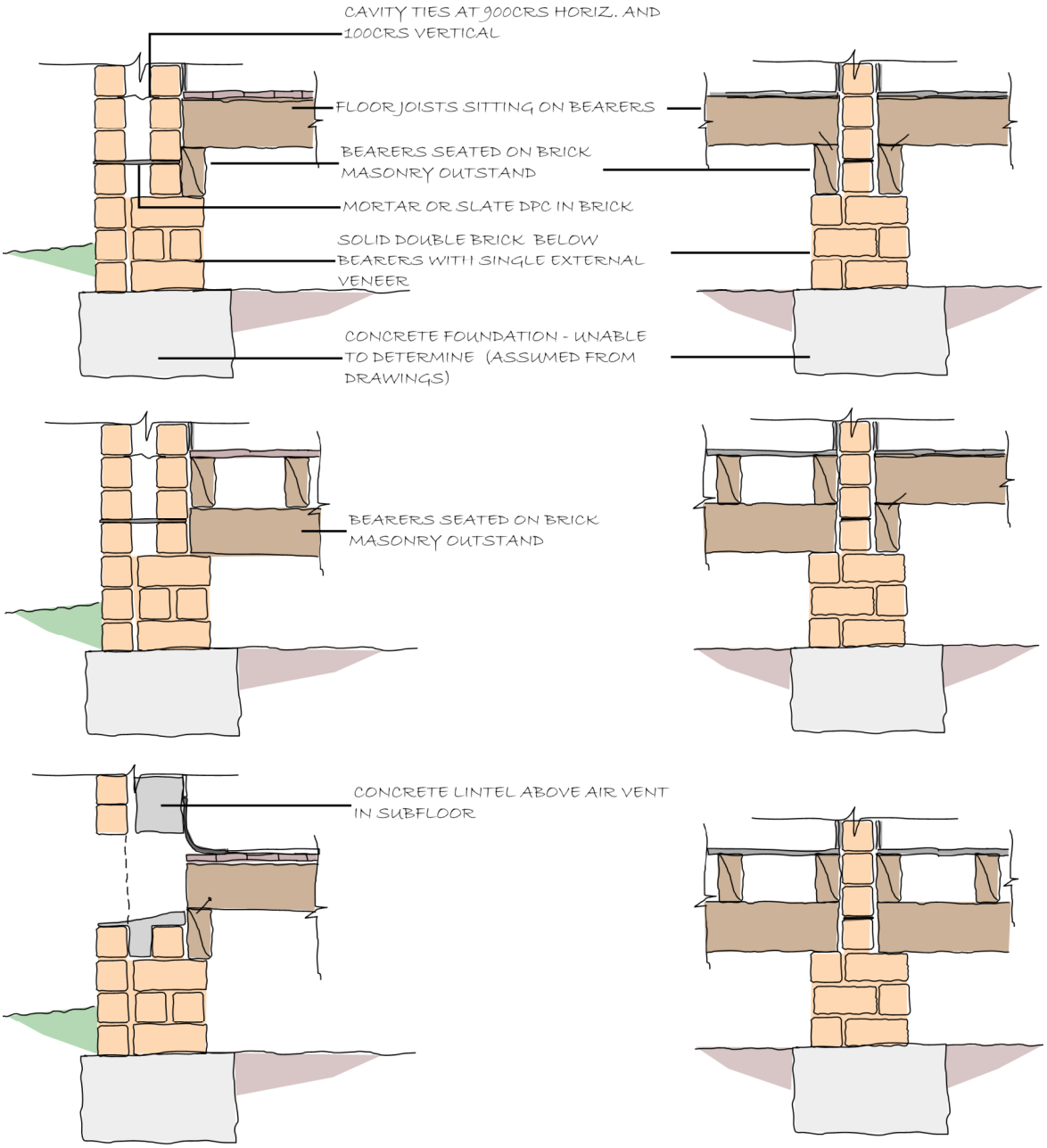

Figure 3: Typical construction details observed (top) typical cross section with joists transverse to exterior walls, (middle) joists parallel to walls (bottom) section through ventilation grate

- Subfloor framing – the subfloor structure generally consists of 140 x 45 timber floor joists at 400 centres supporting 25 thick timber tongue-in-groove flooring. The joists are supported by bearers which span between small brick columns or between the brick foundation walls that continue through from above. There does not appear to be any direct connection (other than gravity support) between the floor and the brick walls, with the walls passing through the floor. No blocking between the timber joists was observed.

Figure 4: Subfloor framing showing timber floor joists connected to timber bearers

- Foundations – the timber bearers sit on brick jack piles. The connection of these was not evident beyond simple bearing on the top surface of the column.
- Lintels – the lintels above windows and doorways are concrete. It is unknown if these are reinforced.

Figure 5: (left) Timber bearer sitting on solid brick column (right) concrete lintel above doorway

A plan mark-up of the various wall types and details are appended to the back of this letter.

Conclusions

The building has extensive use of unreinforced masonry (URM) load bearing internal single skin partitions and external cavity walls. Cavity ties were observed in the cavity walls, however the spacing and condition of these is inadequate to provide robust composite action between the two brick whythes. This suggests the external walls will act primarily as single skin walls. Single skin walls are particularly vulnerable to seismic shaking.

The walls are either cantilever or span vertically between the ceiling and the foundation, likely the former. This means the single layers of brick are particularly vulnerable to local failure, falling from height to form a potential life safety risk. The fact the walls are load bearing means there is a risk of local or global collapse of the roof structure due to failure of the walls, leading to a potential life safety risk for occupants.

The floor structure is discontinuous through the internal walls, and the floor joists are not blocked at their ends. The lack of a connection to the floor means the walls are required to span down to the foundation level. This also means there is little likelihood of a distribution diaphragm to create a load path to stiffer foundation elements.

Two brick chimneys are present in the building. Chimneys are particularly vulnerable to seismic shaking due to their slender nature, and pose a particular risk due to their height above the structure.

The asbestos ceiling material limits the options available for strengthening works without significant disruption.

Note the area shown in yellow below is the original structure that has a number of potential critical structural weaknesses. The areas in blue and green are of modern construction (1980s) and are expected to perform adequately in an earthquake. Strengthening works are thus concentrated to the original area of the building.

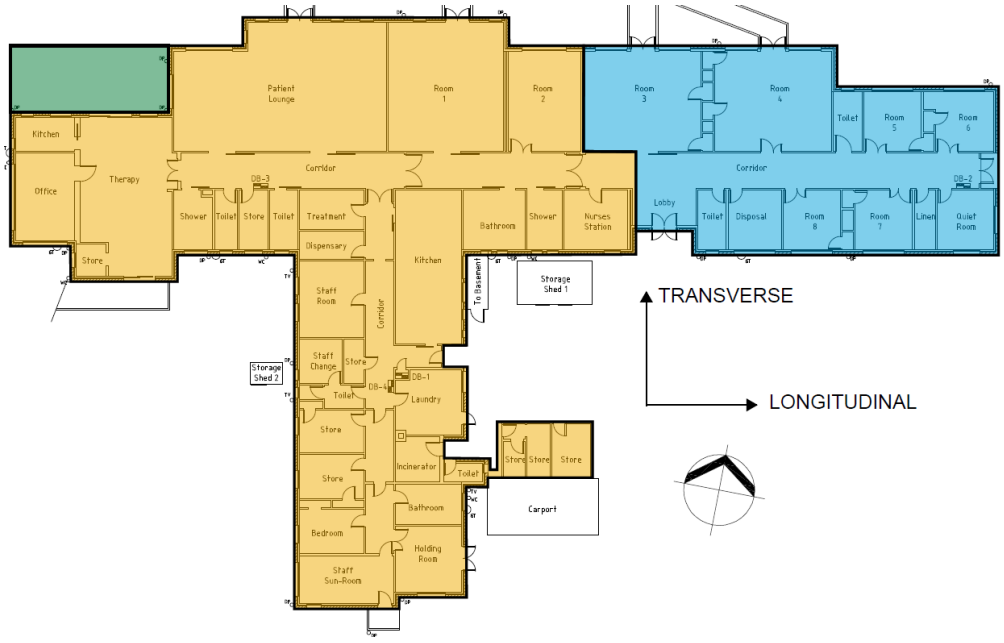

Figure 6: Plan of Franklin Memorial Hospital showing the various construction ages. The yellow section is the original building footprint

Recommendations

The building has a number of critical deficiencies, noted in the ISA and confirmed in the intrusive investigations. Based on the ISA results, the building is currently 'Earthquake Prone' (as it is less than 34%NBS (IL3)). The Auckland City Council Earthquake Prone Policy requires that for earthquake prone buildings:

- Are issued an Earthquake Prone Building (EPB) notice which must be displayed in a prominent location in the building. This notice informs the public and residents that the building is of a high risk.
- The building details are added to the national register of earthquake prone buildings
- Strengthening must occur within 35 years from the date of the EPB notice, such that the building is no longer earthquake-prone. If substantial alterations or change of use occurs within the 35 years, then the building must be strengthened at the same time

Full strengthening works to the building would be intrusive and relatively expensive. The presence of asbestos would make this additionally disruptive. By the EPB legislation, full strengthening would be required by 2054. In the interim, there are a number of short term options which CMH could consider depending on their strategic plan for the building and campus.

Short Term Option 1 – Do Nothing

Works are deferred to a later date.

Short Term Option 2 – Targeted Restraining Works

This option would prioritise the most high-risk aspects of the building to reduce the risk to occupants until the building is decommissioned or further strengthening works are required to be undertaken by Auckland City Councils Earthquake Prone Building policy. Works would be limited to those that have less disruption on residents.

The targeted works would likely involve:

- The removal the brick chimneys,
- Installation of fixing anchors (Python or Helifix fixings) between the cavity brick walls to improve their seismic performance.
- Strapping of timber restraints to the tops of the walls. These will fix through to the brick and span between adjacent walls. This will change the behaviour of the walls from cantilevers to vertical spanning walls, improving their seismic performance.

Disturbance to the occupants would be limited by keeping the works external to the building, or at high level in the rooms. The works will aim to avoid the asbestos materials in the ceiling, allowing operational continuity.

This option provides an improved level of robustness, lowering the key structural risks to occupants, however there will still be a significant cost associated with the works.

Short Term Option 3 – Full Strengthening Works

This option would involve full strengthening of the structure to >34*%NBS* (IL3) or greater. It will effectively create a new internal lining to all the rooms, acting as a new lateral load path.

The strengthening works would likely involve:

- The removal of the brick chimneys
- New structural timber stud walls and lining to all external and internal URM wall. The studs will be fixed through to the brick walls to improve their seismic performance. The new timber studs will also have a top plate securing the top of the brick walls. This top plate will sit under the asbestos material, to avoid disturbing it, and span between adjacent perpendicular walls. Alternatively the internal single skin walls would be removed completed and replaced with timber framing.
- New plywood or GIB ceiling diaphragm between the new wall top plates. The construction of this would be such that it fixes directly to asbestos material, avoiding complete removal of the ceiling structure.
- New connection of the base of the walls to the floor structure through timber blocking bolted through brick.
- New blocking between floor joists and connection of the bearers to the brick substructure

This will require extensive work to most of the building, displacing staff and residents. The costs associated for this option will also be significant.

The works could require the removal of asbestos in the building, although design would aim to avoid this.

Long Term – Full Strengthening Works

The building will require strengthening to the 'Option 3' level.

Summary and Our Recommendations

We propose discussing the options with CMH. We consider Option 3 is the appropriate response in the long term, but alternate options may be necessary in the short term.

Table 1: Summary of Short Term Options for Strengthening Franklin Memorial Hospital

Option No.	Description	Immediate Costs	Seismic Performance	Disruption
1	Short Term – Do Nothing	-	👎	👍
2	Short Term – Targeted Restraining Works	$$$	👍👍	👎👎👎
3	Short Term – Full Strengthening to >34%*NBS* (IL3)	$$$$	👍👍👍	👎👎👎👎

Next Steps

We recommend from here:

- CMH consider the above, and we discuss directly and in more detail each of these options.
- If either Option 2 or 3 are chosen, we will develop a concept design for the works which will inform some initial pricing.

Yours sincerely

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Technical Director - Structural Engineering

on behalf of
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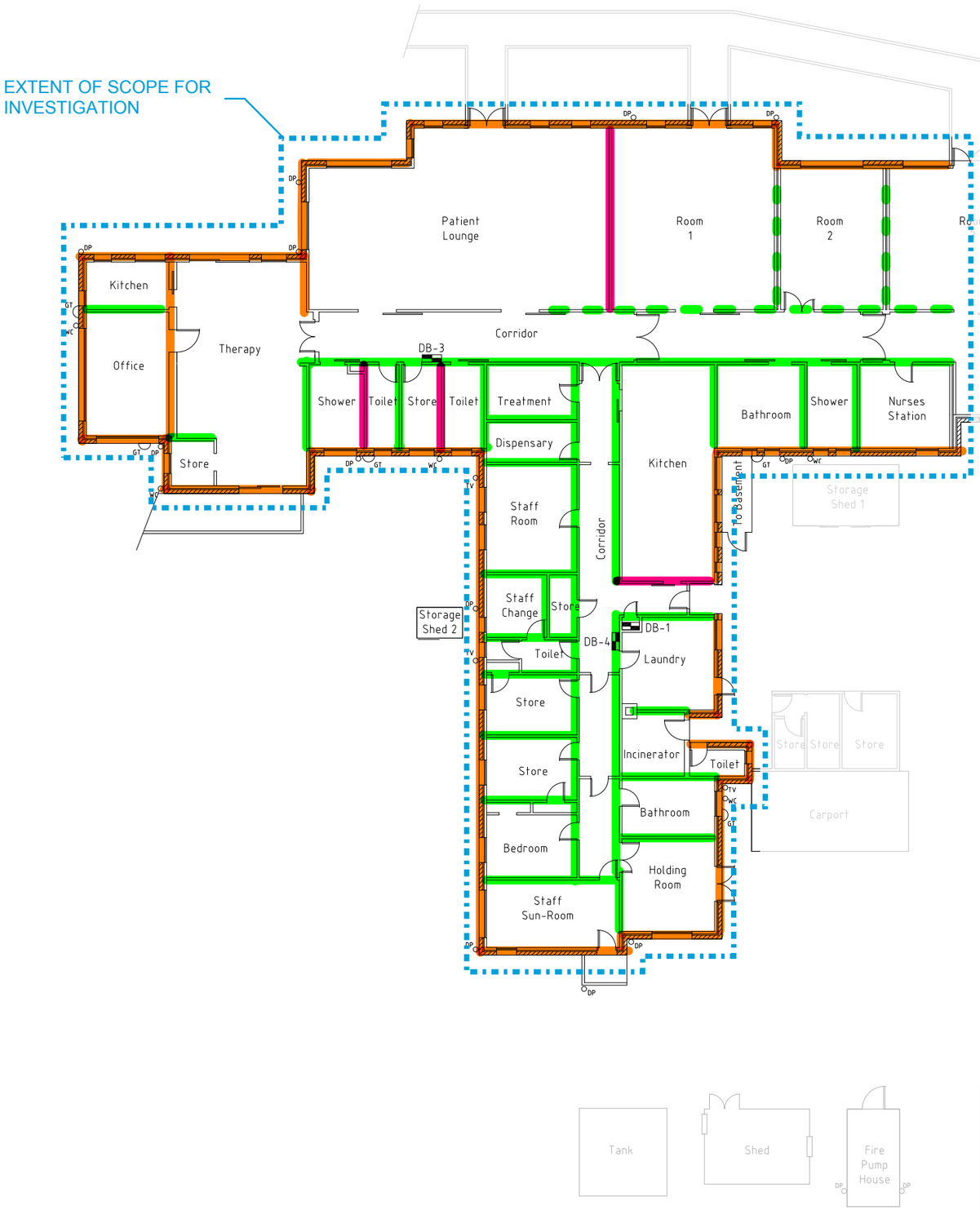


OBJECTIVES OF INVESTIGATIONS:

To determine whether the brick masonry walls observed in the Franklin Memorial Hospital Building are:

a.) Load-bearing or veneer / partition walls
b.) Cavity, single leaf, or solid brick construction (may vary up height of building)
c.) Have ties in the cavity, or veneers are tied back, and the condition of these ties
d.) Have suitable connection details to restraints at ceiling/roof, ground floor, and foundation locations

The information gathered will feed into the strengthening and restraining works for the building.

NOTE THAT ASBESTOS IS PRESENT IN CEILING MATERIAL, AND CEILING SPACE. DAMAGE TO THE CEILING MATERIAL AND ACCESS TO THE CEILING SPACE IS PROHIBITED.

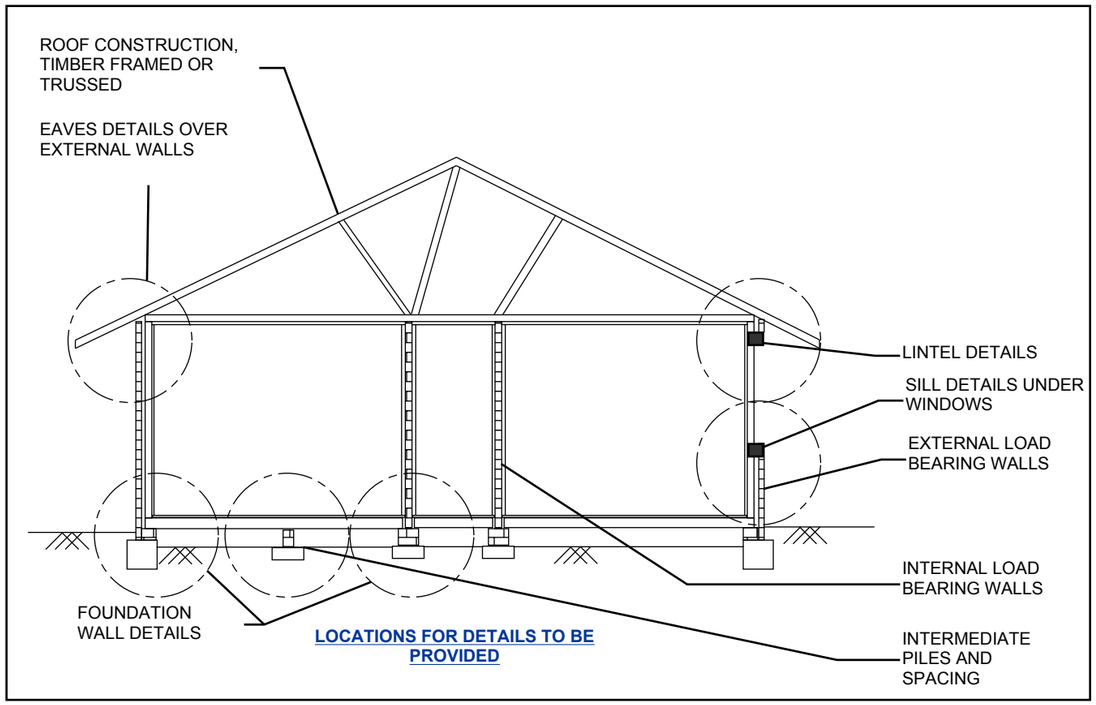
INSTRUCTIONS FOR INTRUSIVE INVESTIGATIONS:

In first instance, information shall be gathered by visual inspection. Where required, intrusive investigations may be undertaken.
For walls shown,
1.) Drill brick and use key hole camera to view and inspect the details of the wall. Alternatively a brick may be removed. Take measurements of details including:
   a.) Cavity width
   b.) Brick dimensions incl. mortar thickness
   c.) Use a stud finder to work out spacing of studs to timber framed walls. Check presence of dwangs to timber stud walls
2.) Take photographs of connections and within cavity for evidence of ties or restraint.
3.) Sketch elevation of wall communicating construction observed
4.) Scratch brick and mortar to confirm condition and hardness and record. Observe general condition of the wall with focus on horizontal cracking in bed joints, vertical cracking in header joints, and diagonal cracking near openings.

Also general investigations required:
1. Confirm if ceiling is lathe and plaster
2. Confirm presence of roof tile ties to the tile battens

OUTPUT REQUIRED:

1. This drawing (19-01-Grnd-A.01) to be marked up with the wall type based on the legend below. A blank copy has been included.
2. Summary sheet for each wall / section requested filled out. An example is included with this documentation.
3. Photographs of the intrusive / opening up findings



LOCATIONS FOR DETAILS TO BE PROVIDED

LEGEND:

- Double cavity wall (orange highlighter)
- Double cavity wall with timber framed lining
- Single skin wall (green highlighter)
- Single skin wall with timber framed lining
- Timber framed walls

PLEASE PRINT IN COLOUR

Beca

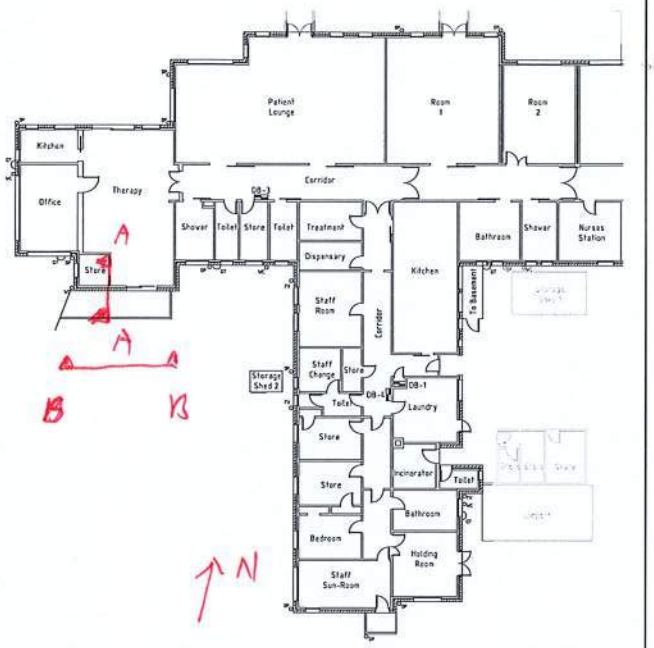
JOB TITLE:	COUNTIES MANUKAU HEALTH SEISMIC ASSESSMENTS		
SKETCH TITLE:	INTRUSIVE INVESTIGATION - FRANKLIN MEMORIAL HOSPITAL		
DATE:	05/04/2019	JOB No.:	5321175
SCALE:	NTS	SKETCH No.:	5321175-E03-SK01
DRAWN:	HM	REV:	1
VERIFIED:	JH	APPROVED:	JK
REASON FOR ISSUE:	FOR INFORMATION		
SOURCE OF BACKGROUND:	CMH DRAWING - 19-01-Grnd-A.01		

INTRUSIVE INVESTIGATION - BRICK MASONRY INSPECTION

Section No.: Exterior Wall 1

Description/ Comments: Exterior wall on southern side of building. Removed the Ventilation net to observe cavity construction. Bricks with minor cracks

Location of detail / sketches:



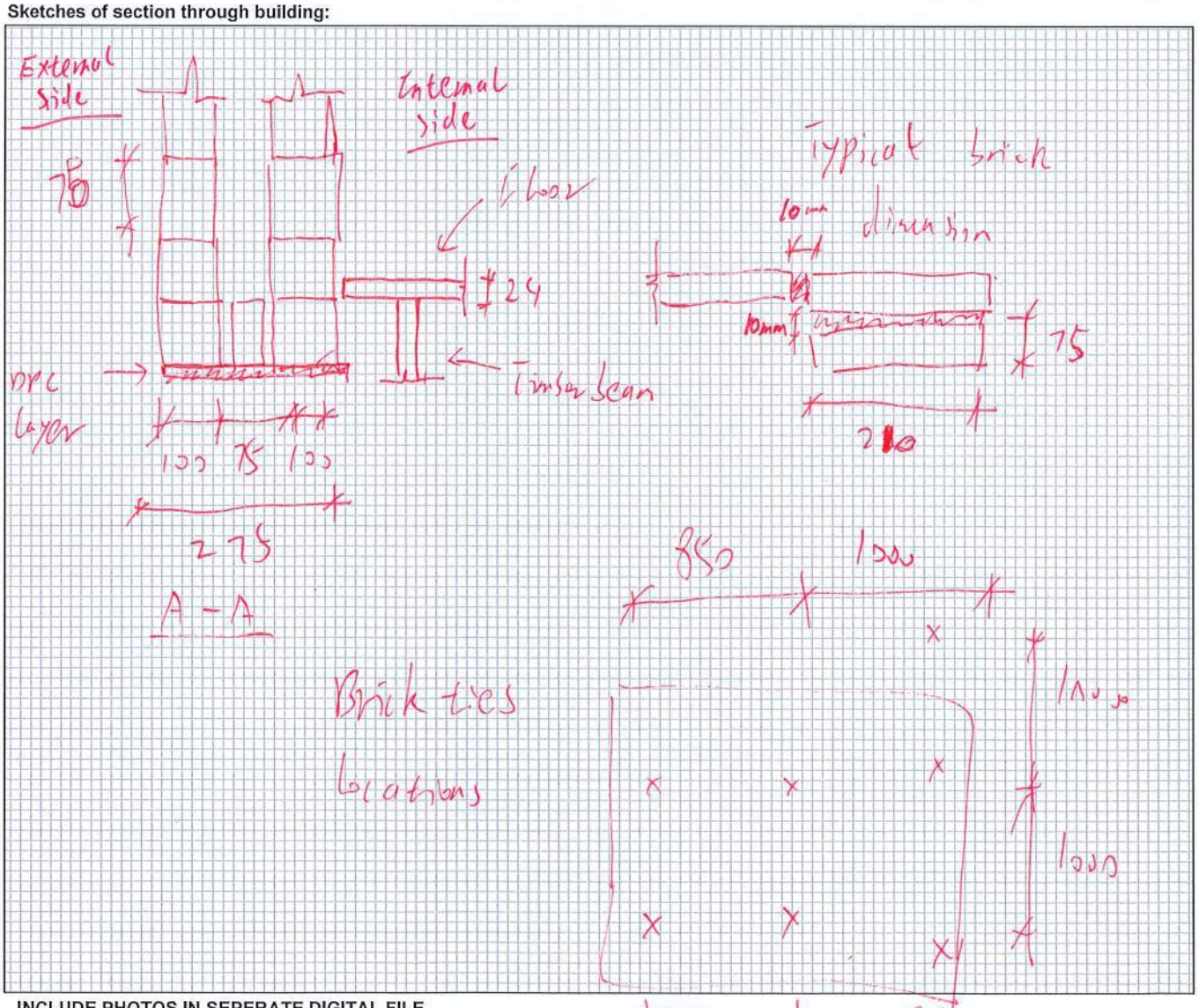
Condition of mortar:

Very soft - raked out by finger pressure	☐
Soft - scratches easily with fingernails	☐
Medium - scratches with fingernails	☐
Hard - Scratches with aluminium pick	☑
Very Hard - Does not scratch with above tools	☐

Condition of brick:

Soft - Scratches with aluminum pick	☐
Medium - Scratches with 10 cent copper coin	☐
Hard - Does not scratch with above tools	☑

Sketches of section through building:



INCLUDE PHOTOS IN SEPERATE DIGITAL FILE

INTRUSIVE INVESTIGATION - BRICK MASONRY INSPECTION

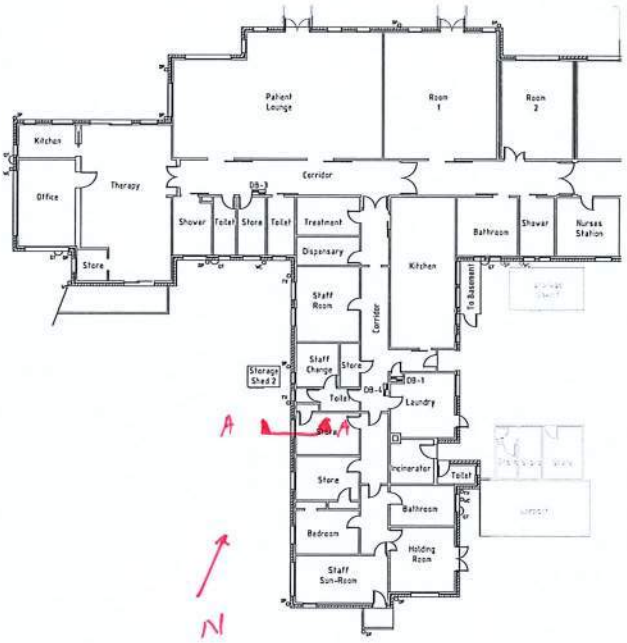
Section No.: Exterior wall 2

Description/ Comments: Exterior wall on western side of building.

Removed ventilation net to observe cavity construction.

Wall in good condition with minor cracks.
- Brick tie spacing similar to wall 1.

Location of detail / sketches:



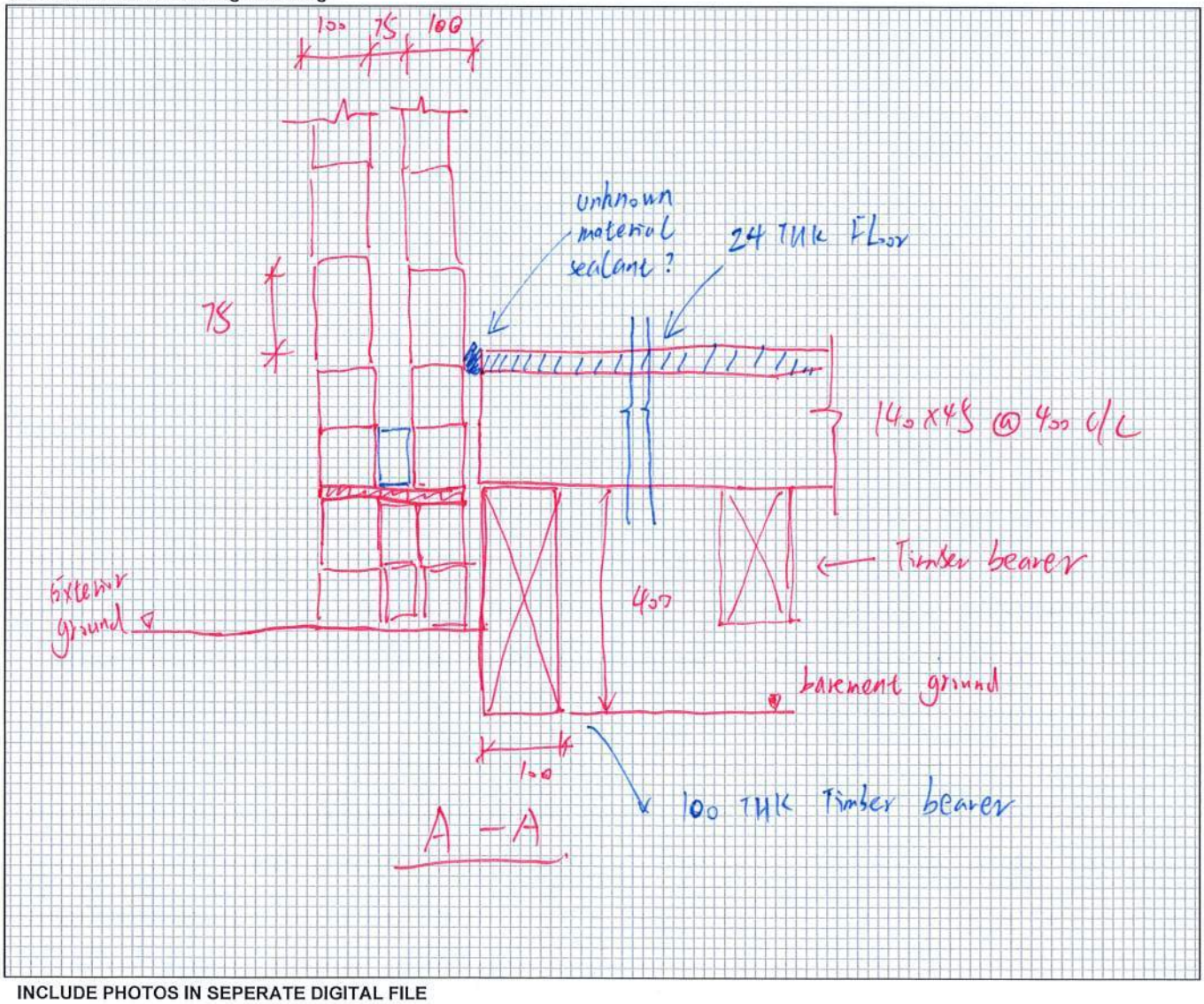
Condition of mortar:

Very soft - raked out by finger pressure	☐
Soft - scratches easily with fingernails	☐
Medium - scratches with fingernails	☐
Hard - Scratches with aluminium pick	☑
Very Hard - Does not scratch with above tools	☐

Condition of brick:

Soft - Scratches with aluminum pick	☐
Medium - Scratches with 10 cent copper coin	☐
Hard - Does not scratch with above tools	☑

Sketches of section through building:



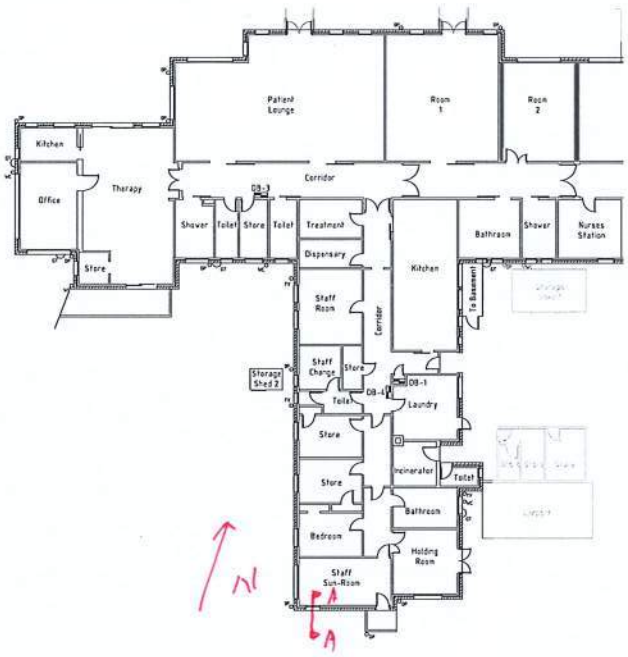
INCLUDE PHOTOS IN SEPERATE DIGITAL FILE

INTRUSIVE INVESTIGATION - BRICK MASONRY INSPECTION

Section No.: Exterior wall 3

Description/ Comments:
- New Mortar repair in late stage
- wall recess 75mm from exterior
- No brick tie found on this wall
- Minor cracks on bricks

Location of detail / sketches:



Condition of mortar:

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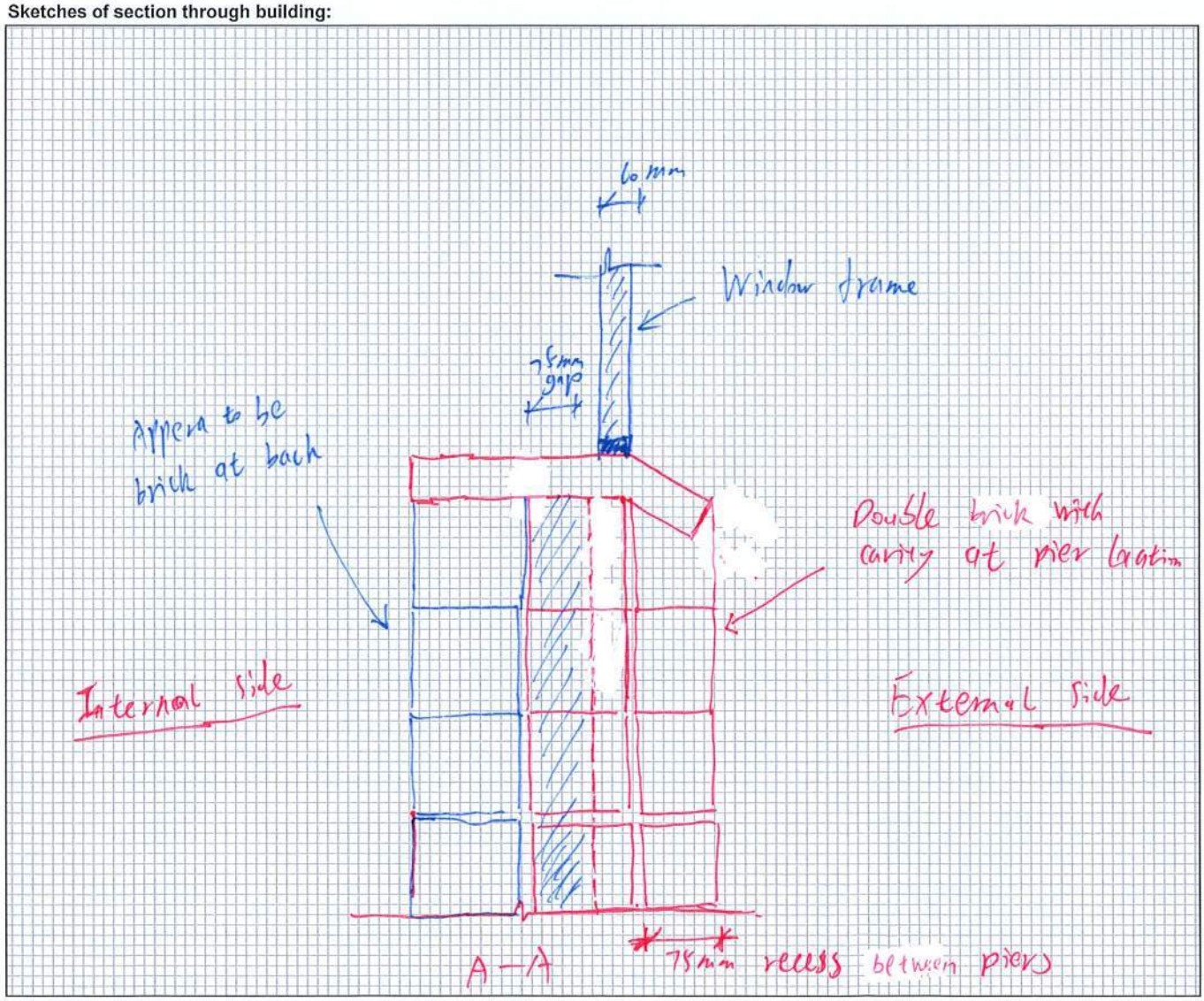
Medium - scratches with fingernails	☐
Hard - Scratches with aluminium pick	☑
Very Hard - Does not scratch with above tools	☐

Condition of brick:

Soft - Scratches with aluminum pick	☐
Medium - Scratches with 10 cent copper coin	☐
Hard - Does not scratch with above tools	☑

Sketches of section through building:



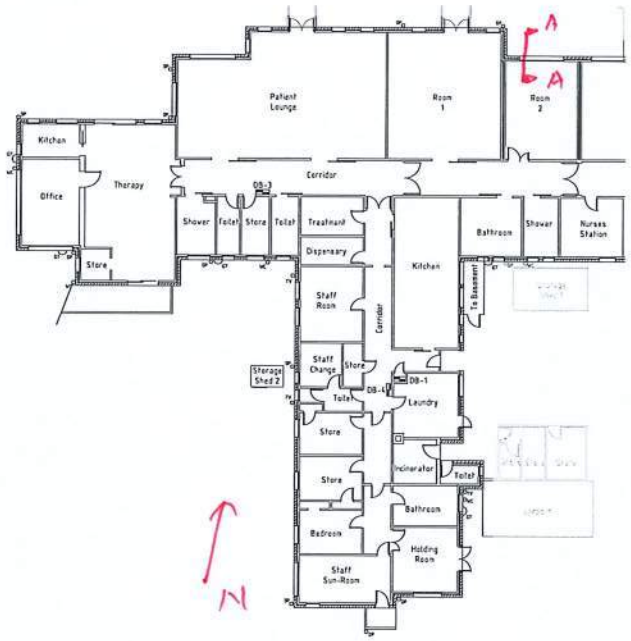
INCLUDE PHOTOS IN SEPERATE DIGITAL FILE

INTRUSIVE INVESTIGATION - BRICK MASONRY INSPECTION

Section No.: Interior Wall 1

Description/ Comments:
- No J16 wall inside
- feel like wall paper
+

Location of detail / sketches:



Condition of mortar:

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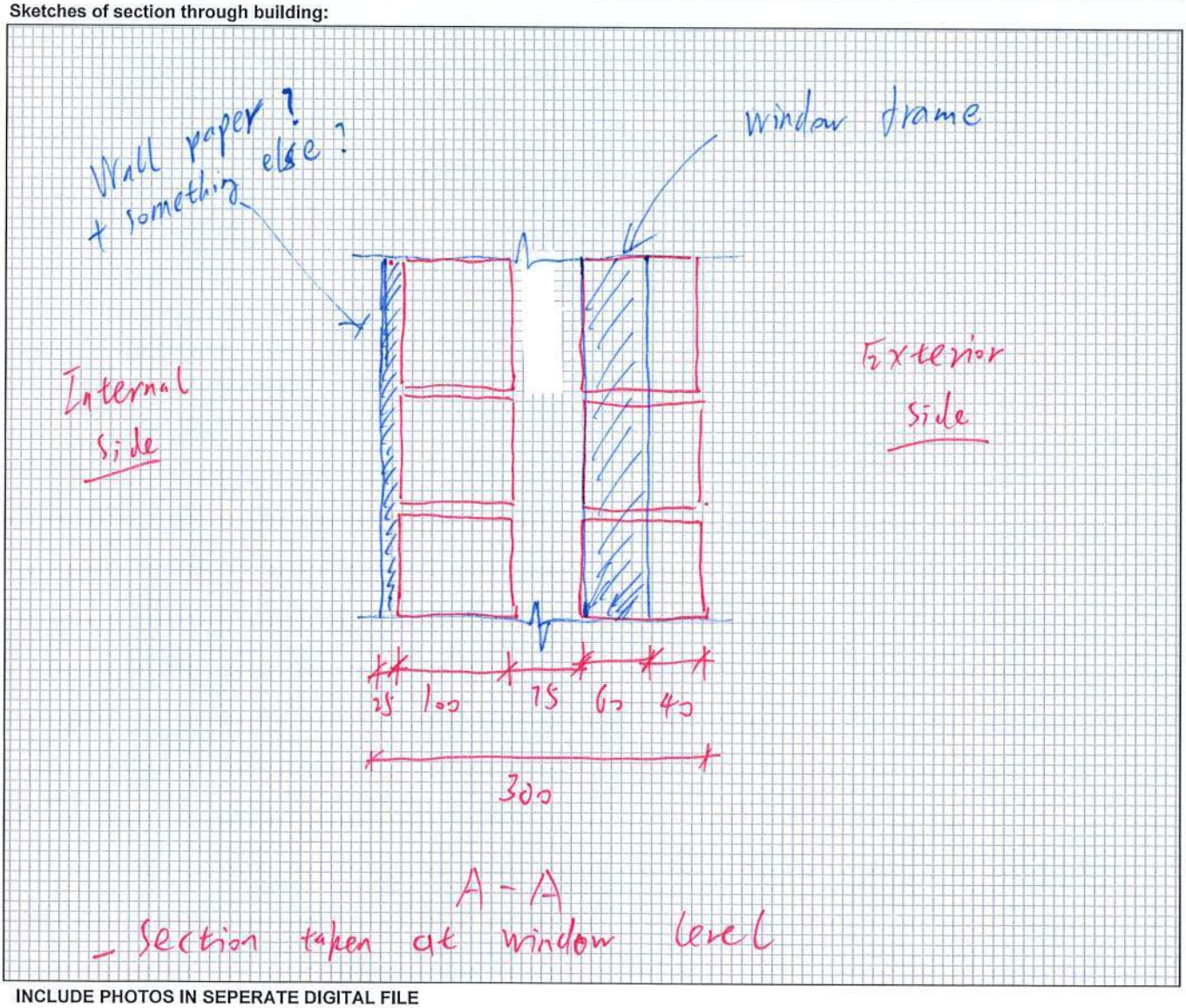
Condition of brick:

Soft - Scratches with aluminum pick	☐
Medium - Scratches with 10 cent copper coin	☐
Hard - Does not scratch with above tools	☐

Sketches of section through building:



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